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His memory, more living now than any of his living words, must fade as those who knew him pass. Yet his life has done work which must endure. Whether he attracted or repelled, he never left indifferent those whom he influenced, and he influenced almost all who came within his range. Among the scholars and teachers who have made the study of the English language and of English Literature important in American universities, he was second only to Professor Child, his elder by half a generation. Child, like Lounsbury, may soon be little more than a name, or the shadow of a name. But the spirit of them lives and shall live so long as the language and the literature they loved and taught are studied and taught and loved.

BARRETT WENDELL.

CHARLES SEDGWICK MINOT (1852-1914.)

Fellow in Class II, Section 3, 1882.

Charles Sedgwick Minot was born in Boston, December 23, 1852. His parental home, five miles from Boston, and comprising about thirty acres, stood on the edge of the forest area which then stretched from Forest Hills on the north to the Blue Hills and the Great Ponds in Canton and Braintree on the south. The region even now, as seen from the summit of Blue Hill, is largely a low forest, most of it of second and third growth, with areas of cleared land in which are small towns and villages, with farm lands about them. There are interspersed fine villas inhabited by wealthy Bostonians, and most of the Forest is now included in the Metropolitan Park system and will be preserved. There are extensive low marshy flats, subject to overflow, along the Neponset River, and included in the forest there are large areas of swamp. Fine trees, elms, oaks, ash, beeches and pines abound in the region, but the trees in the forest areas are generally small. The flora and fauna are abundant and diversified. It is a stimulating region even now to a boy who has the capacity to see things and joy in seeing the wonder and beauty in nature. In Minot's boyhood the region must have been much wilder and hence more interesting than now. In such surroundings the boy grew up and early acquired the love of nature, the capacity of seeing, and the scientific curiosity to find out the meaning of the things he saw, which distinguished the life of the man.

He was a member of a large and well known family, with inherited wealth and distinguished in useful service. The usual course for a boy in his social class would have been to go through Harvard College and it is uncertain why he went to the Institute of Technology instead. The Institute had but recently been founded, it was just entering upon the great career which it has attained, and had the glamour of a new enterprise. At that time Minot could not have obtained in the Institute much stimulation in the study of natural science which from boyhood he had enthusiastically followed. He had already, at the age of sixteen, made his appearance in scientific literature by the description of the male of *Hesperia Metea*, a small butterfly captured in Dorchester and of especial interest because only the female of the species had been previously found. He derived probably a great stimulus from the meetings of the Boston Society of Natural History, which he regularly attended and took part in the discussions. He graduated from the Institute in 1872, at the age of twenty. The influence of the training he acquired at the Institute can be seen in his later life by the interest he had in mechanics and which led him to devise a number of laboratory instruments, among them the well known Minot microtome, which were characterized by simplicity of structure and admirable adaptation to the end in view. The microtome made it possible to cut thin serial sections of organs and is now, with slight and unimportant modifications, the instrument almost universally used for this purpose.

After graduating from the Institute he studied for a time with Agassiz, but he found the most congenial atmosphere in the laboratory of his friend, Henry Bowditch, who had returned from Europe in 1871 and established the first physiological laboratory in this country. Minot was his first research student and found in the older man both a congenial friend and an enthusiastic teacher. The period was one in which teaching in medical science with the laboratory as a basis was just beginning in this country. Previous to this the only laboratories, if they could be called such, in connection with medical schools were the dissecting rooms, and in Bowditch's laboratory the torch of science which was kindled in the ardent flame of the physiological laboratory in Leipzig burned brightly. His work with Bowditch turned his mind into channels which he afterwards followed, his early interest in form and structure being never lost, although modified by his study in physiology of the phenomena of life. In 1874 he published, in collaboration with Bowditch, a paper on the influence of anaesthetics on the vasomotor system, and in 1876 a short paper on transfusion and autotransfusion.

He went to Europe in 1873, working first at Leipzig with Ludwig in physiology, then at Paris with Ranvier in histology, and at Würzburg with Semper in zoölogy. His was not the common fleeting visit to these laboratories, but in each his stay was sufficiently long for him to become acquainted not only with the laboratory work and methods, but with the ideals which directed it. While at Leipzig under Ludwig's direction, he studied the production of CO_2 in the active and resting muscle. He returned to America in 1876 and conducted an extensive series of experiments on tetanus, which was published in 1878, and in the same year received from Harvard University the degree of Doctor of Science.

In 1880 he received his first academic appointment, that of Lecturer on Embryology in the Harvard Medical School, and Instructor in Oral Pathology and Surgery in the Dental School. At that time it was unusual anywhere that instruction in a medical subject should be given by a person who had never taken the degree of Doctor of Medicine, and the appointment of Minot was a distinct break in the academic tradition. The appointment was due to the far-sighted intelligence of Mr. Eliot, who recognized the ability of Minot and desired for the Medical School the influence which a man trained in the traditions of pure science would exert on both the faculty and the students. The appointment was not welcomed in the faculty, and for a long time Minot undoubtedly suffered from his supposed deficiencies. The idea that a man teaching in a medical school should have some knowledge of disease and be able to give an added interest to the subject he teaches by pointing out the practical application of what is taught is not altogether a faulty one, for medicine, certainly for the majority of those entering into it is an art, but like all other arts founded on science. In 1883 he was advanced to the position of Instructor in Histology and Embryology, and this subject was given a satisfactory place in the curriculum, though it was a number of years before laboratory instruction in this subject was made obligatory and a definite part of the course. In the year 1887 he was advanced to the position of Assistant Professor. After the usual term of five years he was made Professor of Histology and Embryology, and when the James Stillman Professorship of Comparative Anatomy was founded he was transferred to that position. Upon the death of Doctor Dwight, in 1911, the subjects of Anatomy and Histology were placed together, and in 1912 he was made Director of the combined laboratories.

As a member of the faculty Minot was always outspoken, clear and logical. He never sought to obtain any end by suavity or the

claims of friendship. His arguments were always keen, definitely to the point in view which was strongly presented, sometimes even too much so. There is apt to be some suspicion in the minds of men when a policy advocated is too clearly presented; it is not flattering to those holding the opposite view. The general discussions in medical faculties do not suffer from clear and logical statement, and Minot's presentation of a subject was in marked contrast to that usually heard. While it often took a long time for men to agree with him, and he usually obtained what was desired, there was never a suspicion that the ends in view were personal and selfish. His active support could always be obtained for any measure looking to the betterment of instruction and the advance of scientific interest.

He was in all respects an admirable teacher; as a lecturer simple and clear, interesting, often enlivening the subject by shafts of keen humor, and in the laboratory stimulating, always insisting that the students should cultivate the faculties of independent observation and judgment. Minot was the first to introduce into the medical schools of the country the laboratory method of student instruction, and the way is never easy for the pioneer. It was a method new to the students, for the men entering the medical schools seem to acquire neither in the home, nor in the schools, nor in the colleges sufficient training in the methods of science. Minot lived to see the modest beginning of this method of teaching, which he made under most unsatisfactory conditions in the old Medical School on Grove Street, become the dominant method used alike in the pre-clinical and clinical branches.

Minot was an excellent director of a laboratory. His laboratory was always orderly, giving one entering it the impression given by a well ordered household. He devised a method of giving each student the use of a microscope by having him pay the school a small sum, which sufficed for their upkeep and renewal. He early began the collection of embryological material, the embryos being cut in serial sections and arranged in suitable and permanent steel cabinets which he devised. In the course of time this grew into an unrivalled collection, serving an admirable purpose, not only in teaching, but in research also, as is shown by the number of researches based upon the material of the collection. The collection was freely used by the other departments of the school, so that any question arising which was wholly or partly based upon the course of embryological development could be here studied on admirably preserved material. Minot gave much time and thought to the plans for his new laboratory at

the school and here first put into effect what he described as the laboratory unit. The unit of the teaching laboratory is a room for twenty-five students, provided with the essential instruments for laboratory work and under the direction of one instructor. The entire class comes together for lectures and demonstrations. The method renders it possible to extend a laboratory indefinitely without confusion, provided the necessary space and instructors are at hand. Minot had moreover an excellent business sense and made the small budget at his disposal cover a wide field.

He was a prolific writer, his most striking contributions being not in small single researches, but in more extensive publications in which he brought together and made more serviceable the accumulated knowledge of a subject. Sometimes, as in the case of his well-known *Human Embryology*, the work covered a large field. This large and comprehensive work, the result of ten years labor, was in no sense a compilation, but was based on his personal knowledge of facts, expanded by the knowledge contributed by others. The American edition was published in 1892 and a German edition in 1894. Of this work His, at that time the leading anatomist of Germany, says, "Minot's work is at present the fullest embryology of man which we possess, and it will retain its value as a bibliographical treasure-house even after its contents in many parts have been superseded." He early became interested in the subject of growth, the stimulus probably coming from Bowditch, who was carrying on his well known studies on the growth of school children while Minot was working in his laboratory. His first paper on the subject, 1878, was "Growth as a Function of Cells" which was quickly followed by another "On Certain Laws of Histological Differentiation" and in the same year he presented in an address "On Conditions to be Filled by a Theory of Life" an outline of his future work. There were many papers on the subject of growth and senescence, the whole being brought together in a book "The Problem of Age, Growth and Death" based on lectures at the Lowell Institute, March 1907. This work has been so well analyzed by Lewis in his *Memoir* that I quote from it. "Senescence and rejuvenation were studied by tabulating the weights of guinea-pigs from birth to old age, and of rabbit embryos up to the time of birth, using weight as a measure of growth. The conclusion was drawn that the fertilized ovum is endowed with an enormous power for growth, over ninety-eight per cent of which has been lost at the time of birth. The remaining two per cent is largely exhausted in infancy. Therefore he concludes that "senescence is at

its maximum in the very young stages and the rate of senescence diminishes with age." He protests against "the medical conception that age is a kind of disease," chronic and incurable, of any such nature as intestinal intoxication or arteriosclerosis. On the contrary he finds that it has a cytological cause, equally operative in the lower animals which have neither intestines or arteries and in man; and he ascribes senescence to the increase and differentiation of cytoplasm as compared with nucleoplasm.

In 1901 he proposed "the new term cytomorphosis to designate comprehensively all the structural alterations which cells, or successive generations of cells may undergo, from the earliest undifferentiated stage to their final destruction." His latest works on this subject, aptly characterized as "thoughtful and suggestive," refer to cytomorphosis as a most promising field for further study, and at the time of his death, plans had been made for careful investigations to test the validity of his cytomorphic hypothesis concerning age."

Of Minot's shorter contributions perhaps the best known is a paper, 1900, "On a hitherto unrecognized form of blood circulation in the organs of Vertebrata." Everyone was familiar with the differences in the thin walled capillaries running in the connective tissue of most organs, easily compressible, their calibre varying with the activity of the circulation, and the vessels in the liver which were wide, closely applied to the parenchyma and whose calibre cannot easily vary. He regarded such vessels not as capillaries but as sinusoids, showed their manner of development and the organs in which they were found.

Minot was greatly in demand as a giver of addresses and these cover a wide range of subjects. His style was vigorous, graceful, the subject enlivened by humor, sometimes with a little satire, and always interesting. They were collected and issued in a German translation under the title "Die Methode der Wissenschaft und andere Reden" — Jena, 1913. Altogether he has published more than one hundred and eighty notes and papers, including his addresses.

In 1912-1913 he was Harvard Exchange Professor at Berlin and Jena, and used the position largely in bringing to the attention of his German colleagues the amount and character of the contributions of American investigators. The position was very enjoyable to him, for he renewed and extended his wide acquaintanceship with the German men of Science.

Minot possessed a wide acquaintance with scientific men here and abroad; he was constant in his attendance on scientific meetings, taking part in the discussions, and occupying a prominent place in

the conduct of societies. He was at different times chosen President of the Naturalists, the Anatomists, the American Association for the Advancement of Science, and the American Academy of Arts and Sciences, and was frequently a member of the councils and of important committees. He was an active or corresponding member of many of the learned societies of Europe, and was honored with the L. L. D. of Yale, 1899, Toronto, 1904, St. Andrews University, Scotland, 1911, and Sc. D. of Oxford, 1902.

No account of Minot would be complete without some mention of his beautiful country home at Hyde Park, the region over which he must have rambled as a boy. The house was a plain one, roomy, furnished simply and in exquisite taste, and stood near the road, the land sloping away from it toward the south and west to a low lying wood, through which a small brook ran. The whole place was in keeping with Minot's character. It was well ordered in its plan and keeping. The trees he planted were properly placed, selected with care, and were fine specimens of the species. He bought a large number of seedlings of many varieties and as these grew he selected from them the finest specimens for planting. Every tree and shrub was well cared for and showed the effects of this in their health and vigorous growth. The garden, formal in design, with well kept grass paths, was at the foot of the slope, some distance from the house, and entered through a small arbor covered with climbing roses. Though formal, it was not severe and contained good specimens of the usual annuals and perennials and many rare plants. The two plants to which he gave most attention were irises and peonies, of each of which, but particularly of the latter, he had a large and rare collection. There were several hundred varieties of peonies, every plant showed intelligent care, and his system of cataloging and labelling was as simple and complete as the system in his laboratory. It was a great joy to go with him among the blooming peonies and see their beauty through his observant and well trained eyes. It is not an easy thing for an amateur gardener to obtain the prizes of the Massachusetts Horticultural Society, but Minot obtained prizes both for peonies and for the general excellence and beauty of the garden as a whole. The grounds and garden showed that highest art by which art is concealed and every plant grew and bloomed as though for the mere joy of living under conditions in all respects the best. There was a profusion of bloom from the earliest spring bulbs to the late chrysanthemums. Many of his plants had a personal history which he would delightfully relate, as having been procured under unusual conditions, or being

transferred to a more suitable situation, or having developed some uncommon and interesting characteristic. He was most generous with his plants, delighting to assist young beginners in horticulture. Through the wood along the brook there wandered a simple path, along the sides of which were many flowering plants collected from the swamps and fields, each in the situation best adapted for its growth and display; as a mass of dog toothed violets at the base of a decayed stump overgrown with moss, or a yellow mass of marsh marigolds intermingled with the beautiful though malodorous swamp cabbage.

I first became acquainted with Minot through the series of excellent articles on anatomy of the uterus and the changes associated with pregnancy, which were published in 1886 in the Handbook of the Medical Sciences, to which I also contributed. He was at all times a delightful companion, always loyal as a friend, sympathetic and helpful. He never hesitated to testify to his friendship. He was in all things generous, in helping younger men both materially and otherwise, a hospitable host, one who knew how to make a guest feel that he contributed to the pleasure of the host. He spoke well on most subjects, as an impromptu speaker thought came clearly and quickly and was expressed in simple language and without hesitation.

In June, 1889, he married Lucy Fosdick of Groton, Mass., in whom he found a sympathetic, helpful companion, and those who knew Minot will always associate her in their thoughts of him.

Science has been enriched by his life; in devising instruments which facilitated work, in teaching and inculcating good methods, in the research he personally conducted, and in his masterful method of presenting the work of others he added to the sum of knowledge and made its pursuit more profitable. He was a good patriotic citizen with high ideals of civic duty. He increased the joy of living by bringing to many people a richer and fuller sense of the beauty of living things; the world is a better place by his having lived.

In the preparation of this Memoir I have made use of the Memoirs by Frederick T. Lewis, by H. H. Donaldson, and by Charles W. Eliot.

W. T. COUNCILMAN.